892XA -521/-529

DMM Interface Option

Instruction Manual

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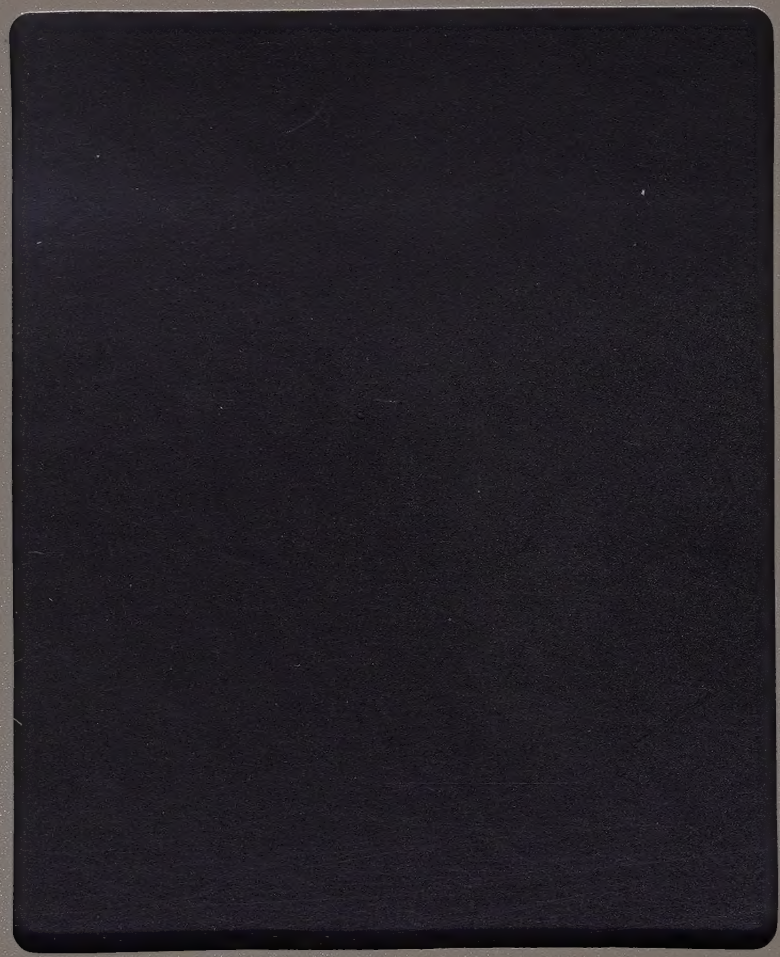

NOTE

This manual documents the 892XA-521 and the 892XA-529 DMM interface Options and their assemblies at the revision levels shown in the Manual Change Information. If your interface contains assemblies with different revision letters, it will be necessary for you to either update or backdate this manual. Refer to the supplemental change/errata sheet for newer assemblies or to the Manual Change Information for older assemblies.

892XA -521/-529 DMM Interface Option

Instruction Manual

P/N 510768
July 1979
Rev. 1, 2/81

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In the event of failure of a product covered by this warranty, John Fluke Mfg. Co., Inc., will repair and calibrate an instrument returned to an authorized Service Facility within 1 year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within 1 year of the original purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions of operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

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All shipments of JOHN FLUKE MFG. CO., INC., instruments should be made via United Parcel Service or "Best Way"* prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

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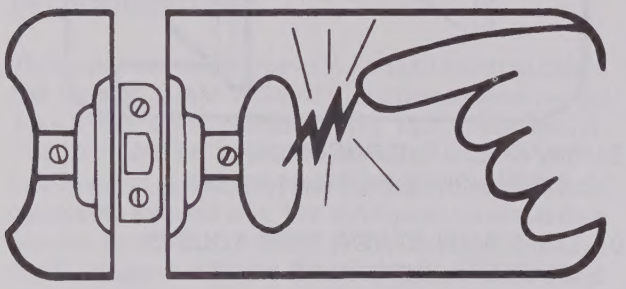
John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206

Rev. 6/81

static awareness

A Message From

John Fluke Mfg. Co., Inc.

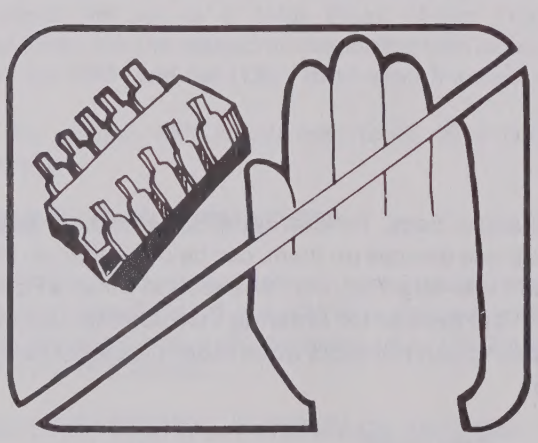


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

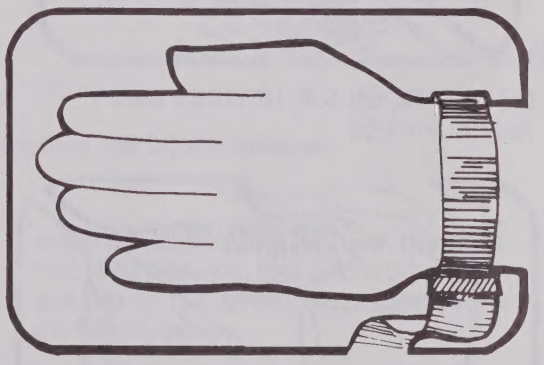
1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol "⊗"

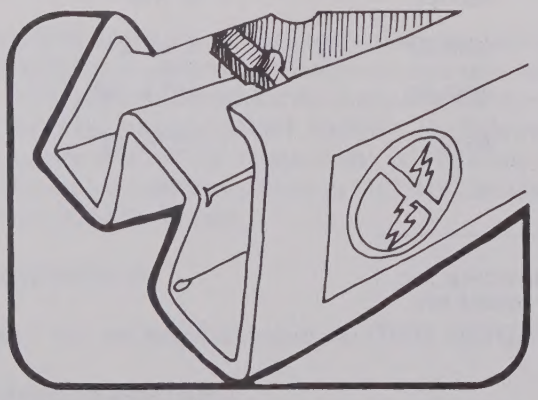
The following practices should be followed to minimize damage to S.S. devices.



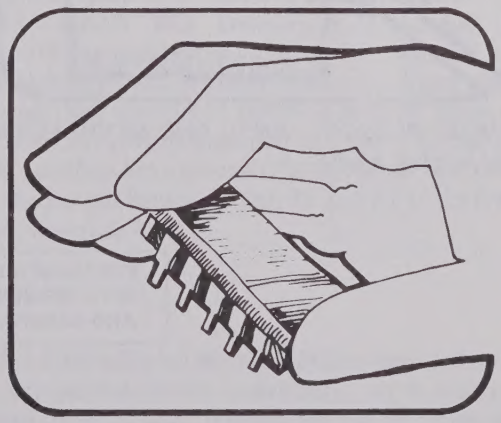
1. MINIMIZE HANDLING



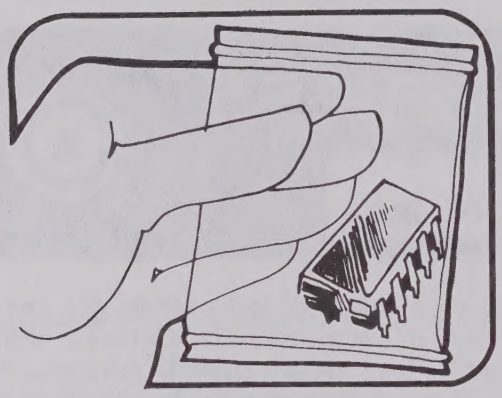
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



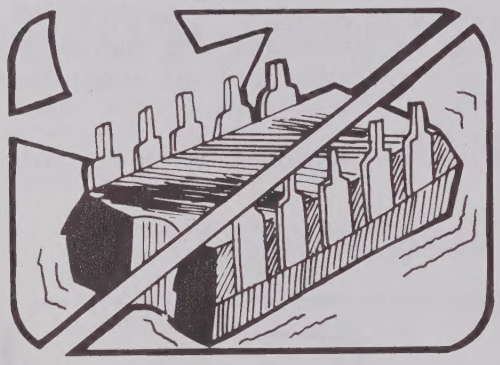
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



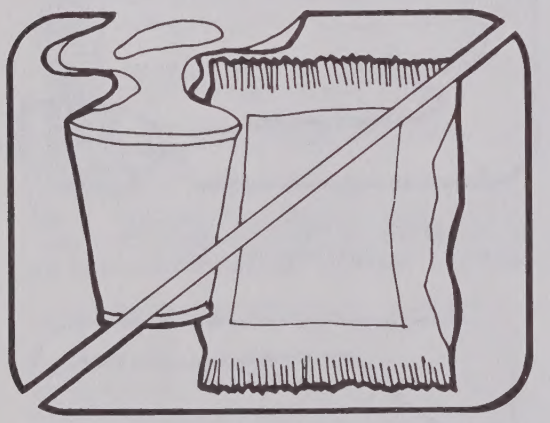
4. HANDLE S.S. DEVICES BY THE BODY



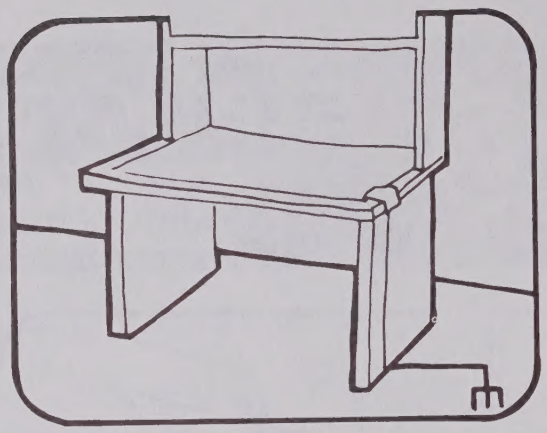
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYRAFOAM® IN WORK AREA



8. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION

9. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

10. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Bag Size
453522	6" x 8"
453530	8" x 12"
453548	16" x 24"
454025	12" x 15"

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WARNING

OBSERVE THE PRECAUTIONS ON THE STATIC AWARENESS SHEET WHEN HANDLING THE PCB ASSEMBLIES OF THESE OPTIONS.

INTRODUCTION

This manual describes the -521 DMM Digital Interface and the -529 DMM-IEEE-488 Interface options for the John Fluke DVM Models 8920A, 8921A, and 8922A. The -521 Option provides optically isolated DVM measurement and dB reference data upon demand from a compatible external unit. The -529 Option translates data between the DVM and the IEEE-488 Bus as defined in the IEEE Standard 488-1978. The -529 Option is composed of one -521 Option and one -522 DMM-1120A Interface PCB. (A maximum of 10 DMMs or DVMs -- each with their own -521 Option -- can be connected to one -522 DMM-1120A Interface PCB. Use the John Fluke Model Y2034 Interconnect Accessory for the physical connection.) The -522 DMM-1120A Interface PCB is intended for use in a John Fluke Model 1120A Translator. Use this manual in conjunction with either or both the DVM and the 1120A Instruction Manuals.

In this manual, 892XA will refer to all three DVM models.

ORDERING INFORMATION

Either interface can be ordered as an option when ordering your DVM. If your DVM is equipped with a -521 Option and you wish to convert to a -529 Option, order kit 892XA-522K.

-521 DMM DIGITAL INTERFACE OPTION

Introduction

The DMM Interface provides a compatible external unit with DVM measurement or dB reference data each time the DVM display is updated if the external unit properly addresses the interface (DMM Address). The following paragraphs describe the compatibility requirements of the external unit and how to operate the DMM Interface through the external unit.

Specifications

Table 1 lists the specifications of the DMM Interface.

THE EXTERNAL UNIT

The external unit must be able to provide:

1. Operating Power (GND and +5v dc at 10 ma).

2. DMM Address: the proper DMM address must be maintained on the address lines (A0-A3) as long as DVM data is desired. If the DMM Address is changed or transmission is stopped, the DMM Interface will stop communication.

The external unit should:

1. Check the DVM's signal that it has received the correct address -- the $\overline{AV}$ line will go low.

2. Use the DVM data in the format presented in Table 2. This data is presented nibble-serial on the W, X, Y, Z lines in the same sequence that data is presented to the DVM display.

3. Read a DVM data-nibble only while the $\overline{DV}$ line is low.

Selecting the DMM Address

WARNING

WHEN SOLDERING ON THE PCB, OBSERVE THE SOLDERING PRECAUTIONS PRESENTED IN THE MAINTENANCE PORTION OF THIS MANUAL.

The DMM Address is coded into the INSTRUMENT NO. solder-jumper positions located next to U11 on the -521 DMM Digital Interface PCB. For compatibility with a 2020A, 2021A, or 2030A Printer ensure that INSTRUMENT NO. position 4 is shorted. For compatibilty with the -522 PCB, ensure that INSTRUMENT NO. position 1 is shorted. If you want to use more than one DMM Interface with the same -522 PCB short jumpers as indicated in Table 4 so that each DMM Interface has a unique DMM Address. Insure that there is a jumper between points E1 and E2 on the DMM Digital Interface PCB.

Operation

The -521 DMM Digital Interface PCB is intended for use with compatible Fluke instruments or a customer designed external unit. Instructions for operation with other Fluke instruments are included in their operating instructions.

Table 1. DMM Digital Interface Specifications

MECHANICAL:

Connector Type: 36-pin AMP "Blue Ribbon Type" series connector. DMM connector is female. Compatible external unit connector is male.

Pin Identification:

PIN NO.	MNEMONIC	SOURCE		DESCRIPTION
		DMM	EXT UNIT	
1	$\overline{AV}$	X		Not Address Valid - Low indicates DMM is responding to a valid address.
2	$\overline{DV}$	X		Not Data Valid - Low indicates that DMM data on W, X, Y, Z is valid.
3	A0		X	LSB } DMM Address
4	A1		X	
5	A2		X	
6	A3		X	MSB
7 & 8	NOT USED			
9	Z	X		LSB } BCD DMM data transmitted nibble-serial.
10	Y	X		
11	X	X		
12	W	X		MSB
13-16	NOT USED			
17	GND		X	Operating voltages for interface side of DMM Digital Interface PCB circuitry.
18	+5V		X	
19-36	NOT USED			

ELECTRICAL:

Timing: DATA NIBBLE* PRESENT ON WXYZ . . . 160 μs
DV . . . . . 80 μs
COMPLETE DATA SEQUENCE . . . . . 1.28 ms

*These are nominal values
DV may be as short as 30 μs.

Optical Isolation: Data transfer reliable up to 500V ac rms common mode voltage from dc to 440 Hz. Opto-isolators rated for 2500V ac rms at 60 Hz.

Physical Distance between Devices: Less than 3 meters (approximately 10 feet).

Voltage Levels: Based on CMOS technology with +5V power supply and allowance for pull-up resistors.

Logic Levels: Positive-true.

High State: 3.5 to 5V.

Low State: 0 to 1.0V.

Drivers: Tri-state devices with active true signals and 470Ω series resistors.

STATE	OUTPUT VOLTAGE
High	4.6 to 5V at –0.14 mA
Low	0 to 0.7V at +0.36 mA
Off	Maximum leakage current is ±20 μA

Receivers: Resistive termination is 100 kΩ tied to +5V only. Maximum leakage current of receiver is ±20 μA.

STATE	INPUT VOLTAGE
High	3.5 to 5V
Low	0 to 1.5V

Operating Power: Two +5V and GND sources.

+5V and GND supplied by DMM to DMM side of the DMM Digital Interface PCB circuitry.

+5V at less than 10 mA and GND are supplied to the interface side of the DMM Digital Interface PCB circuitry via the interface cable.

Table 2. DVM Data Format on the DMM Digital Interface

DATA FORMAT TABLE

SEQUENCE NO.	W	X	Y	Z	MEANING
1	J	L	M	N	dB Reference/ Status
2	K	a	b	c	Range/Status
3	0	DB	OL	UL	Status
4	B	B	B	B	LSD
5	B	B	B	B	4SD
6	B	B	B	B	3SD
7	B	B	B	B	2SD
8	$\overline{P}$	1	0	Z1	Polarity/MSD

RANGE TABLE

abc	RANGE
000	2 mV
001	20 mV
010	200 mV
011	2V
100	20V
101	200V
110	700V
111	Not Used

dB REFERENCE TABLE

J	0	1
LMN	IMPEDANCE	
000	REL	REL
001	72	52
010	150	50
011	300	75
100	600	93
101	900	110
110	1000	124
111	1200	135

0	binary bit:	logic 0, low
1	binary bit:	logic 1, high
abc	binary range code:	(see inset Range Table)
B	binary data bit:	0 or 1
dB	If dB = 1:	DVM reading is in dB
	If dB = 0:	DVM reading is in volts
DV	Data Valid	low on $\overline{DV}$ line indicates valid data on WXYZ
JLMN	If dB = 0:	J indicates the number of display digits J = 0: 3½ digits; J = 1: 4½ digits
	If dB = 1:	JLMN designates dB Reference selected (see inset dB Reference Table)
K	If K = 1:	DVM will flash decimal point for underload and flash all digits for inputs greater than 700V.
MSD	Most Significant Digit 2SD follows MSD in significance	
OL	If OL = 1:	Overload - DVM input has exceeded capacity for that range.
UL	If UL = 1:	Underload - DVM is below optimum for that range and reading may not be accurate.

Theory of Operation

The DMM Digital Interface PCB (schematic at the rear of this manual) is used to provide electrical isolation between the instrument and the interface data outputs. Power (+5V dc) is supplied from the instrument for driving its side of the interface. The output side must be supplied with +5V dc by the user or the 1120A. Figure 1 shows the signals present in the instrument and the interface which help transfer the data. DVM data is presented nibble-serial, bit-parallel, on the W, X, Y, Z data lines. Each BCD digit in the instrument has an associated strobe. In the middle of the strobe, $\overline{RG}$ provides an edge-protected pulse for clocking the data into a latch. Once each measurement cycle -- when a new value is first available -- BZ goes high for one strobe raster. BZ is clocked into flip-flop 2 of U2 by one of the strobes. This provides a delay so that the first data-nibble output from the DMM Digital Interface may be selected by the choice of strobe on the clock input. Q2 is connected to R1 so that when Q2 is high, Q1 follows S1, but when Q2 is low, Q1 remains high. In this way, only one strobe raster of $\overline{RG}$ pulses is sent out on Q1 each measurement cycle. U1 provides current drive for the LEDs in the opto-isolators U3-U8.

The guard lands on the PCB (illustrated on the schematic by dashed lines up through the opto-isolators) prevent noise from being passed back into the instrument from the output side and aid reliable data transfer at high common mode voltages and frequencies. Since the 892XA has no separate guard, the guard land should be tied to instrument ground by a jumper between E1 and E2.

When the opto-isolator LEDs turn on, the output transistors are driven into saturation (turn on). The 100 kΩ base resistors speed up turn-off by bleeding off charge stored in the transistor base region. When the BCD number present on A3-A0 does not match the jumper

selected INSTRUMENT NO., U11 (a 1-of-10 decoder) puts a high on U9 pin 15 tri-stating the $\overline{AV}$ and $\overline{DV}$ lines. The high on U10 pins 1 and 8 causes U10 pin 4 to be high, tri-stating U9 data buffers for W, X, Y, Z.

When the instrument number is selected on A3-A0, $\overline{AV}$ goes low and $\overline{DV}$ goes high. The RS flip-flop formed by U10 is designed to prevent output of a partial data sequence. U10 pin 4 will not go low, enabling data lines, W, X, Y, Z and allowing $\overline{RG}$' to control $\overline{DV}$, until both U10 pins 8 and 9 are low. If the instrument number is applied during BZ', no DV pulses will be output until the end of the next measurement cycle. A time delay (R27 and C2) gives the external unit time to prepare to receive data after addressing a DMM. Data will be present on W, X, Y, and Z continuously after U10 pin 4 goes low. R13-R26 provide limited protection for CMOS parts U9 and U11.

-529 DMM-IEEE-488 INTERFACE OPTION

Introduction

The -529 DMM-IEEE-488 Interface Option is composed of one -521 DMM Digital Interface PCB and one -522 DMM-1120A Interface PCB. Material relating to the -521 Option appears earlier in this manual. The -522 DMM-1120A Interface PCB must be installed in a John Fluke Model 1120A Translator. The 1120A Instruction Manual contains information on operating the 1120A and instructions for installing the -522 DMM-1120A Interface PCB. The following paragraphs contain the information necessary to operate the -529 Option as an interface between the DVM and the IEEE-488 Bus.

Specifications

Table 3 lists the specifications -- including the IEEE-488 Bus format of DVM data -- for the -529 Option.

Configuration Selection

You are provided with several configuration choices by the position of 1120A front panel controls; the position of the -522 DMM-1120A Interface PCB inside the 1120A; and by the INSTRUMENT TYPE/ADDRESS, TALK ONLY, and SUPPRESS ALPHA solder-jumper positions on the -522 DMM-1120A Interface PCB. The following paragraphs detail each of these choices.

MY TALK ADDRESS (MTA)

MTA is used in conjunction with My Secondary Address (MSA) to designate one DVM connected through the -529 Option as a talker. The MTA of a particular -529 Option is determined by the positions of 1120A front panel switches and the position of the -522 DMM-1120A Interface PCB in the 1120A. Refer to the 1120A Instruction Manual for information on coding MTA.

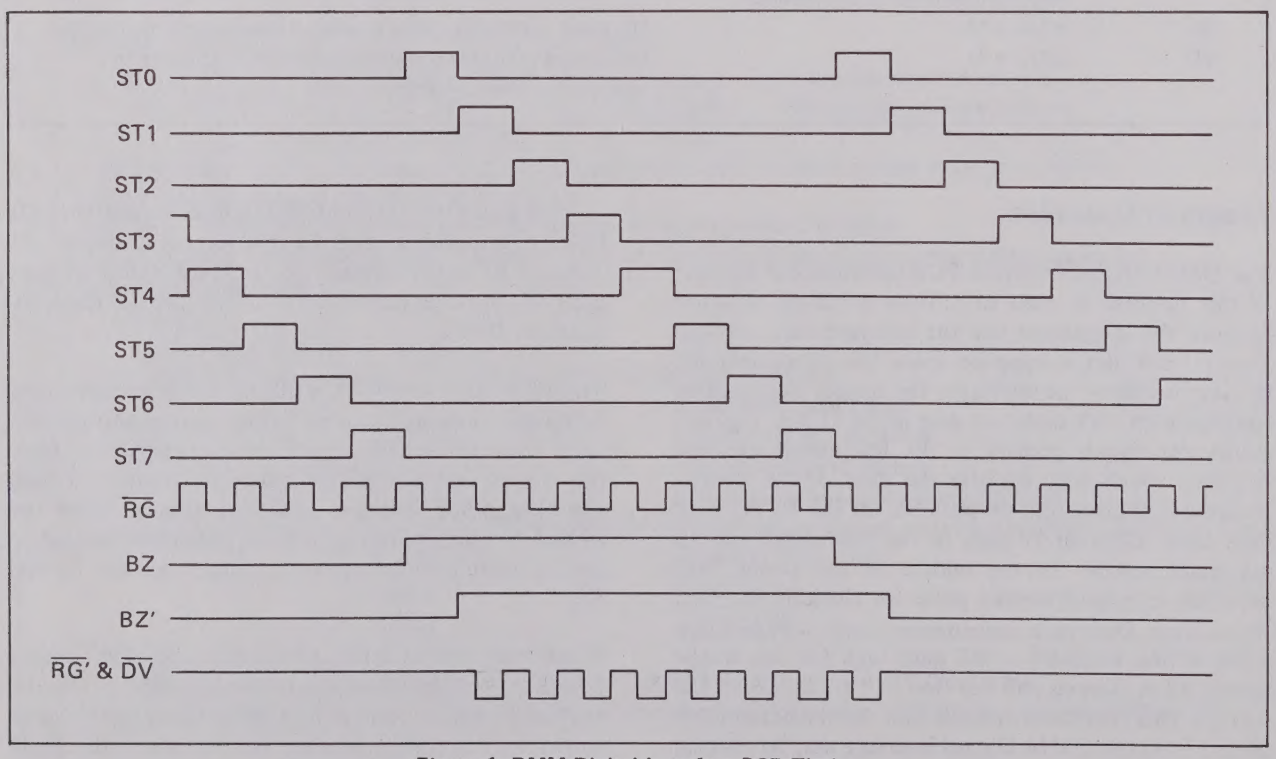


Figure 1. DMM Digital Interface PCB Timing

Table 3. DMM-IEEE Interface Specifications

DMM RELATED SPECIFICATIONS:

All DMM related specifications are listed in the DMM Digital Interface Specifications, Table 1.

IEEE-488 RELATED SPECIFICATIONS:

Electrical: See 1120A Instruction Manual

Mechanical: See 1120A Instruction Manual

Software:

Interface Functions Implemented:

SH1	(Source Handshake) Interface Function
AH1	(Acceptor Handshake) Interface Function
T3	(Talker) Interface Function Including Talk Only
TE3	(Extended Talker) Interface Function
L0	(Listener) no capability
SR0	(Service Request) no capability
RL0	(Remote Local) no capability
PP0	(Parallel Poll) no capability
DC0	(Device Clear) no capability
DT0	(Device Trigger) no capability
C0	(controller) no capability

Approximate source handshake data rate: 8900 bytes/sec.

Approximate acceptor handshake data rate: 3000 bytes/sec.

Message Transmission Rate: One message can be sent each measurement cycle of the addressed DMM.

Data Format: All data sent in ASCII.

	FORMAT	EXAMPLE MESSAGES
Measurement	[+/–] D.D.D.D[.D] [E–3] [,<alpha>] <CR><LF, EOI> Where alpha = (>/</space)DB or (>/</space)V	1.375, V 19.687, V 0.36E–3,<V, } Only if instrument is in 4½ digit mode. –3.02, DB +75.00, >DB
dB Reference	DB REF CCCC<CR><LF, EOI>	DB REF 1000 DB REF 50 DB REF REL

1. MNEMONICS

+/–	Polarity sign, if used.
C	ASCII character - alpha or numeric.
D	Digit - most leading zeros are not sent.
.	Possible decimal point location.
E+/–D	Exponent in engineering units; D is in multiples of 3. If D = 0, the exponent portion is not sent.
<CR>	Carriage return
<LF,EOI>	Line feed - send simultaneously with EOI (End or Identify).
<number>	A sequence of ASCII characters representing a numerical value.
<alpha>	A sequence of ASCII alphabetical characters.
>	Overload.
<	Underload.
[]	Characters in brackets are optional.
/	Indicates choice of characters.

2. The optional non-numeric ,<alpha> portion of the measurement data messages may be suppressed (not sent) by shorting the SUPPRESS ALPHA solder jumper on the –522 DMM-1120A Interface.

Table 3. DMM-IEEE Interface Specifications (cont)

Instrument Related Timing:*	
DATA TRANSFER AND CONVERSION	2 ms
CYCLE TIME	400 to 575 ms Nominal, 600 to 775 ms Overload

WHERE:

* Cycle time is the time the instrument requires to make one measurement.
Data Transfer and Conversion time is the ime required for the instrument to transfer data to the microprocessor plus time for the microprocessor to reformat data before it can be sent on the IEEE-488, If ATN is asserted by a controller during the data transfer and conversion period, that data is lost.

MY SECONDARY ADDRESS (MSA)

MSA can either be sent by the Controller or it can be coded on the INSTRUMENT TYPE/ADDRESS solder-jumpers on the -522 DMM-1120A Interface PCB. (If the TALK ONLY solder-jumper position is shorted, MSA must be coded on the INSTRUMENT TYPE/ADDRESS solder-jumpers.) MSA corresponds to the DMM Address. With Instrument No. position 1 shorted on the 892XA-521 PCB, an MSA of 1 will yield Measurement Data and an MSA of 4 will yield dB Reference Data. (Note that the MSA's for the two types of data were different but the DMM INSTRUMENT NO. was the same.) When connecting only one instrument to a -522 PCB, an automatic MSA of 1 can be sent to the -521 by shorting INSTRUMENT TYPE/ADDRESS positions 1 and 6 on the -522 PCB. These solder-jumper connections remove the requirement for secondary addressing but will allow only measurement data (Positions 1 & 6) or dB Reference Data (Positions 3 & 6) to be output.

TALK ONLY

If the interface is to be used in a "dumb" system, where the interface is to be the only talker on the IEEE-488 Bus (such as when data logging on a printer), short the TALK ONLY solder-jumper position and program MSA on the INSTRUMENT TYPE/ADDRESS solder-jumper positions on the -522 DMM-1120A Interface PCB.

SUPPRESS ALPHA

If you want the alpha or non-numerical portion of the DVM measurement message (shown in the specifications table) to be omitted from the IEEE-488 Bus transmission, short the SUPPRESS ALPHA solder-jumper position on the -522 DMM-1120A Interface PCB. (If your pcb does not have a SUPPRESS ALPHA solder-jumper position, short pin 34 of U1 to ground for the same effect.)

Operating Notes

SERIAL POLL PRECAUTION

Do not attempt to serial poll this interface. If the interface is serial polled, it will send the first byte of its data message (which may include RQS). If the interface is serial polled, untalk the interface (failure to do so may result in the transmission of a partial message).

DMM ADDRESS ERROR MESSAGE

If the DVM is incorrectly addressed, the -529 DMM-IEEE Interface may respond with the following error message: ER<CR> <LF,EOI>

OPERATION WITH ONE DVM

Insure that all the instruments are properly connected and programmed and that all instrument controls are in the proper positions. Use the following example as a guide to interface operation:

Given:

1120A address select switches are set to:

0 (A5)
0 (A4)
0 (A3)

-522 DMM-1120A Interface PCB is in slot IF1 (Device 1) of the 1120A.

Instrument No. Position 1 is shorted on the -521 PCB

DVM input is +1.094V ac rms.

DVM controls are set to the following positions:

dB/VOLTS:	dB
REL/dBm:	dBm
dBm REFERENCE (Ω):	600

1. To establish DVM communications with an automatic MSA coded on the -522 DMM-1120A Interface PCB, cause the controller to send MTA 1.

2. To establish DVM communications without the automatic MSA coded on the -522 DMM 1120A Interface PCB cause the controller to send:

a. (for measurement data) MTA 1 MSA 1

The message from the -529 DMM-IEEE-488 Interface should be +3.00, DB <CR> <LF,EOI>

b. (for dB reference data) MTA 1 MSA 4

The message from the -529 DMM-IEEE Interface should be DB REF 600<CR> <LF,EOI>

3. To end DVM communications, cause the Controller to send UNT (Untalk).

OPERATION WITH MORE THAN ONE DMM

NOTE

If DVM models other than 892XA are connected to the same interface as your 892XA, conflicts in DMM Addresses may arise. See Table 4 to avoid DMM Address conflicts.

One -522 DMM-1120A Interface PCB can interface up to ten DVMs or DMMs (each equipped with a -521 DMM Digital Interface Option). Up to four of these ten may be 892XA Model DVMs. Table 4 lists the DMM Addresses and the corresponding MSAs that are allocated to 892XA DMMs. Note that the Controller can request both DVM measurement data and dB reference data from DVMs with INTRUMENT NO. positions; 1, 2, or 3 shorted. Only DVM measurement data can be requested from DVMs with INSTRUMENT NO. position 0 shorted and only dB reference data can be requested from DVMs with INSTRUMENT NO. position 4 shorted. Once the INSTRUMENT NO. has been selected, to get either measurement data or dB reference data from a particular DVM, cause the Controller to send the proper MTA and MSA. To get information from another DVM connected to the same -529 DMM-IEEE-488 Interface, cause the Controller to send the MSA of the new DVM. To stop communications with a particular DVM cause the Controller to send either UNT or the MTA of another instrument.

-529 DMM-IEEE Interface Operation Examples

INTRODUCTION

The following operation examples show how various controllers may be used to collect data from DVMs connected to the -529 DMM-IEEE-488 Interface. The choice of controllers used for the examples does not imply a recommendation.

TEKTRONIX 4051

The basic format for data input is:
<line #> INPUT @P,S:<variable>
where P is the primary talk address of the -522 DMM-1120A Interface PCB and S is the secondary address of the DVM. The primary talk address may be 1 to 31 only as the 4051 will not allow a primary talk address of 0.

Operation with One DVM

In the following examples, the primary talk address is 4 and the DVM is an 892XA with INSTRUMENT NO. position 1 shorted measuring a 1.826 mV ac rms signal. No jumper positions are shorted on the -522 DMM-1120A Interface PCB. The DVM front panel controls are set to the following positions:

POWER:	ON
dB/VOLTS:	dB
REL/dBm:	dBm
dBm/REFERENCE(Ω):	50
HOLD/AUTO:	AUTO

The following are four examples of different data types and data presentations that may be requested using the 4051.

1. To get the entire DVM measurement data message, enter the following into the 4051:

```
100 INIT
110 INPUT @4,1:A$
120 PRINT A$
RUN
```

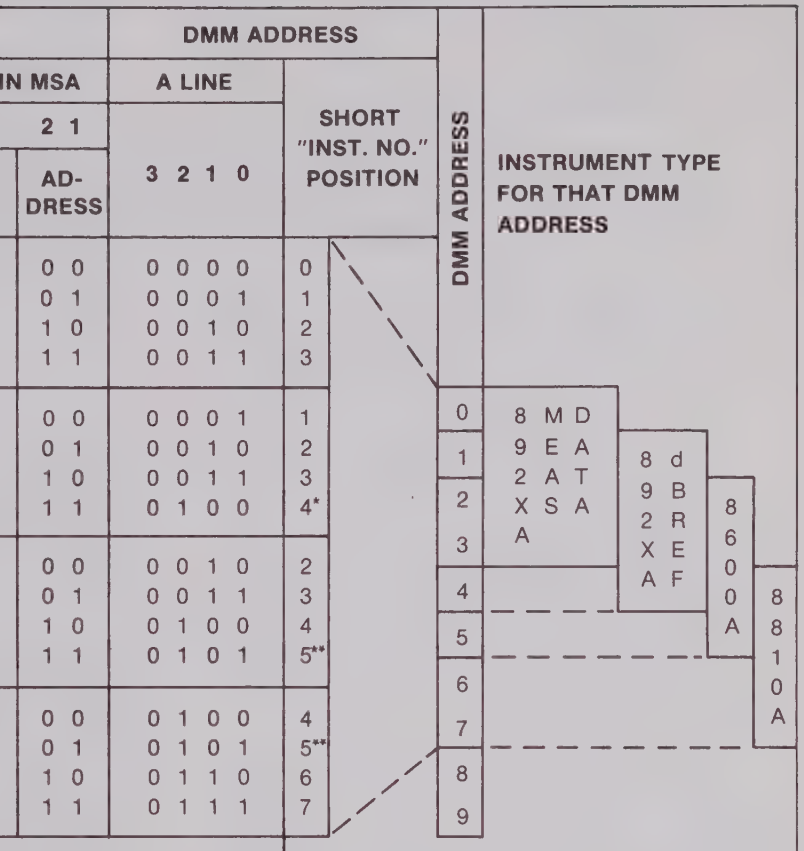
When RUN is entered, the 4051 will initiate the program which will: send IFC on the IEEE-488 Bus; send a primary talk address of 4 and a secondary address of 1, then wait for data; when data is presented on the IEEE-488 Bus by the -529 DMM-IEEE-488 Interface, the 4051 will accept and display the DMM data. In this case, the 4051 screen should display "–41.76, DB".

2. To use the DVM measurement data for further computations, enter the following into the 4051:

Table 4. MSA and DMM Address Selection for Multiple DMM Operation

INSTRUMENT TYPE		MSA NUMBER	MSA 5-BITS IN MSA 5 4 3 INSTRUMENT TYPE	MSA 5-BITS IN MSA 2 1 ADDRESS	DMM ADDRESS A LINE 3 2 1 0	SHORT "INST. NO." POSITION
892XA	Measured Data	0	0 0 0	0 0	0 0 0 0	0
		1	0 0 0	0 1	0 0 0 1	1
		2	0 0 0	1 0	0 0 1 0	2
		3	0 0 0	1 1	0 0 1 1	3
	dB Ref	4	0 0 1	0 0	0 0 0 1	1
		5	0 0 1	0 1	0 0 1 0	2
		6	0 0 1	1 0	0 0 1 1	3
		7	0 0 1	1 1	0 1 0 0	4*
8600A		8	0 1 0	0 0	0 0 1 0	2
		9	0 1 0	0 1	0 0 1 1	3
		10	0 1 0	1 0	0 1 0 0	4
		11	0 1 0	1 1	0 1 0 1	5**
8810A		16	1 0 0	0 0	0 1 0 0	4
		17	1 0 0	0 1	0 1 0 1	5**
		18	1 0 0	1 0	0 1 1 0	6
		19	1 0 0	1 1	0 1 1 1	7

	S5 S4 S3	Instrument Type
+	S2 S1	Address
	A3 A2 A1 A0	DMM Address



* Shorting INSTRUMENT NO. position 4 is requried to operate a FLUKE Printer with an 892XA DVM.

** Shorting INSTRUMENT NO. position 5 is required to operate a FLUKE printer with an 8600A or 8810A DVM.

```
100 INIT
110 INPUT @4,1:D,A$
120 PRINT D,A$
RUN
```

When RUN is entered, the 4051 will initiate the program which will: send IFC on the IEEE-488 Bus; send a primary talk address of 4 and a secondary talk address of 1, then wait for data. When the -529 DMM-IEEE-488 Interface presents DVM measurement data on the IEEE-488 Bus, the 4051 will read the measurement number as a numeric variable and the remainder of the DVM message as a string A$. In this case, the 4051 screen should display "–41.76 , DB".

3. To read only the numeric value of the DVM message, enter the following into the 4051:

```
100 INIT
110 INPUT @4,1:D
120 PRINT D
RUN
```

When RUN is entered, the 4051 will initiate the program which will: send IFC on the IEEE-488 Bus; send a primary talk address of 4 and a secondary talk address of 1, then wait for data. When data is presented on the IEEE-488 Bus by the -529 DMM-IEEE Interface, the 4051 will accept the numerical portion and ignore the remainder of the DVM message.

4. To read the dB REFERENCE data from the DVM, enter the following into the 4051:

```
100 INIT
110 INPUT @4,4: A$
120 PRINT A$
RUN
```

When RUN is entered, the 4051 will initiate the program which will: send IFC on the IEEE-488 Bus; send a primary talk address of 4 and secondary talk address of 4 then wait for data; when the -529 DMM-IEEE-488 Interface presents the dB REFERENCE data on the IEEE-488 Bus, the 4051 accepts and displays the data. In this case, the 4051 screen will display "DB REF 50".

Operation with More than One DVM

Two DVMs are connected to the -529 DMM-IEEE-488 Interface -- one 8810A and one 892XA type instrument. The following conditions are set:

1. Primary talk address of the -522 DMM-1120A Interface PCB is 2.

2. The 8810A is measuring a +5V dc signal and the front panel controls are set to the following positions:

FUNCTION:	DCV
RANGE:	20
POWER:	ON

3. The 892XA is measuring a 1.1V signal and the front panel controls are set to the following positions:

POWER:	ON
AC/AC+DC:	AC
AUTO/HOLD:	AUTO
REL/dBm:	dBm
dBm REFERENCE (Ω):	600

Enter the following program into the 4051:

```
100 INIT
110 PAGE
120 PRINT "<tab> DIGITAL VOLTMETER"
130 PRINT "      DATA COLLECTION VIA
                IEEE-488"
140 PRINT "<tab>STANDARD INTERFACE"
150 PRINT
160 DIM P(10),S(10)
170 PRINT "ENTER NUMBER OF DEVICES:";
180 INPUT N
190 PRINT "ENTER: PRIMARY, SECONDARY
          ADDRESSES"
200 FOR I=1 TO N
210 PRINT I;" ";
220 INPUT P(I),S(I)
230 NEXT I
240 PRINT "NUMBER OF READINGS
          (-1=INFINITY)";
250 INPUT R
260 FOR I=1 TO N
270 INPUT @P(I),S(I):D,A$
280 PRINT D, A$
290 NEXT I
300 R=R-1
310 IF R=0 THEN 1000
320 PRINT
330 GO TO 260
1000 END
```

To request the 4051 to get three DVM measurements from both of the DVMS:

```
RUN
      DIGITAL VOLTMETER
DATA COLLECTION VIA IEEE-488
      STANDARD INTERFACE
```

```
ENTER NUMBER OF DEVICES: ? 2
ENTER: PRIMARY, SECONDARY
       ADDRESSES
1? 2,1
2? 2,8
NUMBER OF READINGS (-1=INFINITY)?3
```

The 4051 screen will display, in sequence:

```
+3.01     , DB
+5.143    ,

+3.01     , DB
+5.142    ,

+3.01     , DB
+5.143    ,
```

HEWLETT-PACKARD 9825

The basic input statement for the HP 9825 is "red7PPSS, <variable>" where PP is the primary talk address and SS is the secondary talk address. Both digits must be used for each talk address (i.e., a primary talk address of 5 would be entered as 05). Unless otherwise stated, the HP9825 must have both the "General I/O - Extended I/O" ROM and the "String-Adv. Programming" ROM. The HP-IB Interface I/O address switch should be set to 7.

Operation with One DVM

Enter "dim A$[20]<execute>" to allow A$ to be used as a string variable and to set the maximum string length. The following examples assume that the -522 DMM-1120A Interface PCB Primary Talk Address is 0 and that the DVM is an 892XA measuring a +5V ac rms signal with the DVM front panel controls as follows:

POWER:	ON
AC/AC+DC:	AC
VOLTS/dB:	VOLTS
HOLD/AUTO:	AUTO

1. To get one DVM data message:

   a. Type:
   <fetch>fo red70001,A$;dspA$<store>
   fo <execute>

   b. The HP 9825 sends on the IEEE-488 Bus:

   ATN UNL
   ATN MLA 5

   ATN MTA 0
   ATN MSA 1

   Then the HP 9825 waits for DVM data.

   c. When the -529 DMM-IEEE-488 Interface sends the DVM data message, the HP 9825 screen displays "5.00, V".

   d. Type:
   <fetch>fo red70001,A$;cmd7,char(95);dspA$
   fo <execute>

   The command, cmd7,char(95) sends UNT on the IEEE-488 Bus. If UNT is not sent, the -529 DMM-IEEE-488 Interface will send the first data message then the first byte of the second data message and wait for the HP 9825 to respond. The HP 9825 will not respond until the next time <execute> is pressed. At that time, the -529 DMM-IEEE-488 Interface will repeat the first byte of the second data message (which was never accepted by the HP 9825) then finishes sending the message sequence. This message is the DVM data immediately following the first <execute>: it is not fresh DVM data and may not agree with the DVM display.

2. To get DVM data messages continuously, type:

<fetch>fo red70001,A$;dspA$;gto–0
fo <execute>

3. To get the DVM message in a form that can be used for further calculations type:

fxd 9 <execute>
This keeps the millivolt readings from being rounded off into a meaningless 0.01 for display.
<fetch>fo red70001, D,A$; cmd7,char(95); dspD, A$ fo <execute>

D is the numeric portion and A$ the alpha portion of the DVM data message.

4. If your unit does not have the "String-Adv. Programming" ROM:

   a. Type: <fetch>fo red70001,D;dspD

   b. This will result in the following command and data sequence:

   UNL
   MLA 5
   MTA 0
   MSA 1
   5.00, (DVM measurement data)
   UNL
   MLA 5
   MTA 0
   MSA 1
   <space>V<CR> <LF,EOI>

c. The unneeded sequence following the numeric data may be deleted by setting the SUPPRESS ALPHA solder-jumper on the -522 DMM-1120A Interface PCB or by sending an OTA as in:

fo: red70001,A;cmd7,"U";dspA

Operation with More Than One DVM

The program below will collect and display data from more than one DMM or DVM which is connected to the one -522 DMM-1120A Interface. In the example following the program, the primary talk address is 0 and one 8810A DMM and one 892XA DVM (secondary talk addresses 16 and 1, respectively) are connected to the -522 DMM-1120A Interface PCB. Note that B$[N] is used only to identify the readings and can be any string within the constraints of the dimension statement.

PROGRAM:

```
0: dim A$[20],B$[10,10],P$[2],S$[2],V$[10]
1: dsp "DIGITAL VOLTMETER";wait 1000
2: dsp "Data Collection via IEEE-488";wait 1000
3: ent "Number of Devices?",N
4: dsp "ENTER: Device,Primary,Sec.";wait 1000
5: for I=1 to N
6: ent B$[I],P$,S$
7: dev B$[I],val("7"&P$&S$)
8: next I
9: for I=1 to N
10: red B$[I],V,V$
11: dsp B$[I],V,V$;wait .500
12: next I
13: gto -4
```

EXAMPLE:

```
<RUN>
DIGITAL VOLTMETER
Data Collection via IEEE-488
Number of Devices? 2<continue>
ENTER: Device,Primary,Sec.
B$[1]? 892XA <continue>
P$? 00 <continue>
S$? 01 <continue>
B$[2]? 8810A <continue>
P$? 00 <continue>
S$? 16 <continue>
```

The HP 9825 will now collect data from the two instruments and display each value for ½ second.

COMMODORE PET 2001- HOME COMPUTER

The PET requires an adapter to connect to the IEEE-488 Bus. The PET will not allow primary talk addresses of 0, 1, 2, or 3. Since the PET does not wait for the IEEE-488 Bus handshake with the -529 DMM-IEEE-488 Interface, it is necessary to test the status byte and repeat the input statement if data is not received. If this causes ATN to interrupt during a data transfer conversion period, the PET will have to wait for an additional DVM measurement cycle to be completed. The PET will hang-up if DVM measurement data does not appear on the IEEE-488 Bus (i.e., invalid address). In this case, you may have to turn the PET off losing the program stored in memory.

Operation with One DVM

Use the following program to request DVM data using the PET:

```
10 OPEN 1,4,1
20 INPUT #1,D$
30 IF ST< >0 THEN 20
40 PRINT D$
100 END
```

Operation with More Than One DVM

Once the program below has been entered, type RUN to use the program, then answer the questions as they appear. The program for operation with more than one DVM is as follows:

```
10 PRINT "     DIGITAL VOLTMETER"
20 PRINT "DATA COLLECTION VIA IEEE-
        488"
30 PRINT "     STANDARD INTERFACE"
40 PRINT"
50 PRINT " ENTER NUMBER OF DEVICES:";
60 INPUT N
70 PRINT "ENTER: DEVICE, PRIMARY,
        SECONDARY
80 FOR I=1 TO N
85 PRINT I;
90 INPUT I$(I),P,S
100 OPEN I+3,P,S
110 NEXT I
115 PRINT "
120 PRINT "  DATA
130 PRINT "
150 FOR I=1 TO N
160 INPUT#I+3,D$
165 IF ST< >0 THEN 160
170 PRINT I$(I);" "D$
200 NEXT I
210 PRINT
300 GOTO 150
1000 END
```

Theory of Operation

The -522 DMM-1120A Interface PCB, as shown on the -522 DMM-1120A Interface PCB schematic, contains an 8048 microprocessor, bus transceivers, control logic, and hard-wire program solder-jumper positions. The microprocessor addresses the DVM, collects DVM data, reformats the DVM data for the IEEE-488 Bus and transmits the DVM data in IEEE-488 Bus format using the three-wire handshake when properly addressed (MTA) by the Controller.

On power up or Interface Clear (IFC), the microprocessor pulls $\overline{\text{RADD}}$ (Not Read Address) low then lets $\overline{\text{RADD}}$ go high and pulls $\overline{\text{RSADD}}$ (Not Read Secondary Address) low. When $\overline{\text{RADD}}$ is low, the microprocessor checks the condition of the TALK ONLY solder-jumper position and reads and stores the primary talker address (same as MTA) from the position of the 1120A front panel controls and the position of the -522 DMM-1120A Interface PCB in the 1120A. When $\overline{\text{RSADD}}$ is low, the microprocessor checks the INSTRUMENT TYPE/ADDRESS solder-jumper positions. If position 6 is shorted, the microprocessor reads and stores the MSA programmed on the 6 solder-jumper positions.

The microprocessor controls the direction of data flow on DIO1-DIO8 by means of $\overline{\text{TALKEN}}$, except that $\overline{\text{RADD}}$ and $\overline{\text{RSADD}}$ also disable input from the DIO lines and ATN prevents conflict with a system controller by tri-stating the DIO output buffers. This hardware disable of IEEE-488 Bus outputs is necessary to meet timing requirements and allow proper communication between all interfaces in the 1120A which use the same set of IEEE-488 Bus buffers.

As soon as the microprocessor gets MSA -- either from the controller or from the solder-jumper positions -- it reduces MSA to the corresponding DMM Address, sends the DMM Addresss on A0-A3, and monitors $\overline{\text{AV}}$ (Not Address Valid). If there is no response on $\overline{\text{AV}}$, the microprocessor will send ER<CR> <LF,EOI> on the IEEE-488 Bus to indicate that an error has occurred. If $\overline{\text{AV}}$ goes low, the microprocessor will monitor $\overline{\text{DV}}$ (Not Data Valid) and collect one nibble of DVM data from the W, X, Y, Z lines each time $\overline{\text{DV}}$ goes low. Once each DVM measurement cycle, the microprocessor changes the DMM data into the IEEE-488 Bus format and checks the SUPPRESS ALPHA solder-jumper position. If SUPPRESS ALPHA is open, the IEEE-488 Bus message will contain the alpha portion of the message. If SUPPRESS ALPHA is shorted, the IEEE-488 Bus message will not contain an alpha portion. If the controller asserts ATN during the time that the -522 DMM-1120A Interface PCB is collecting or formatting data from the instrument, that data is lost and the controller must then wait for the instrument to make another measurement. The microprocessor cannot service the IEEE-488 Bus and simultaneously watch the instrument for new readings.

When the microprocessor receives an MTA from the Controller that agrees with its stored MTA, the DVM data -- now in IEEE-488 Bus format -- is transmitted at a rate determined by the three-wire handshake. Once the -522 DMM-1120A Interface begins to send a measurement value on the IEEE-488 Bus, it does not update the value until it has sent the full message sequence or has been untalked. If the Controller interrupts a message sequence with ATN, but does not send an Other Talk Address (OTA), the remainder of the message will be sent when ATN is removed. If the -522 DMM-1120A Interface is connected to more than one instrument, and has been addressed as a talker, it is only necessary to send the secondary address to change from one instrument to another, provided the controller has not sent any Primary Command Group message other than MTA (i.e., -522 DMM-1120A Interface is in TPAS).

MAINTENANCE

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRICAL SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE EARLIER PORTION OF THIS MANUAL UNLESS YOU ARE QUALIFIED TO DO SO.

Soldering Precautions

Remove the pcb from the instrument. Complete required jumper connections by shorting adjacent jumper holes with a solder bridge (no wire is needed). Jumpers are easily removed by use of a solder sucker. Take care not to overheat the pcb (results in circuit land pattern peeling). The plated-through holes are intended to minimize this problem but may allow hot solder to drip into the instrument if solder is applied carelessly or in excess. Check the bottom side of the pcb after soldering any jumpers to be sure there are no shorts caused by excess solder.

PCB Handling Instructions

Observe the precautions presented on the Static Awareness sheet (located near the front of this manual) when handling the pcb assemblies or devices mounted on the pcb assemblies.

Troubleshooting

Most problems will occur because of improper location of solder jumpers. Be sure that the DMM Digital Interface is being addressed so that the INSTRUMENT NO. solder-jumper line is pulled low. If there are still problems, check connections and supply voltages. Then use an oscilloscope to trace signals from the DVM to the microprocessor. Especially note the output waveforms from the opto-isolators. While they may be considerably distorted, $\overline{RG}$' should not go low less than ½ as long as $\overline{RG}$, and data on W, X, Y, Z should remain stable while $\overline{RG}$' is low.

MANUAL CHANGE INFORMATION

To identify the configuration of the pcbs used in your interface, refer to the revision letter (marked in ink) on the component side of each pcb assembly. Table 5 defines the assembly revision levels documented in this manual with an X.

As changes and improvements are made to the interface, they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual. To backdate this manual to conform to earlier assembly revision levels, perform the changes indicated in Table 5.

LIST OF REPLACEABLE PARTS

Tables 6, 7, and 8 list the replaceable parts of the -521 and -522 options. Figure 2, 3, and 4 illustrate these parts lists. Refer to Section 5 of the DMM Instruction Manual for additional information about ordering parts.

Table 5. Manual Status and Backdating Information

Ref Or Option No.	Assembly Name	Fluke Part No.	* To adapt manual to earlier rev configurations perform changes in descending order (by no.), ending with change under desired rev letter																						
			–	A	B	C	D	E	F	G	H	J	K	L	M	N	P									
-521	DMM Digital Interface PCB	471698	X																						
-522	DMM-1120A Interface PCB	503078	●	X																					

* X = The PCB revision levels documented in this manual.
● = These revision letters were never used in the instrument.
–= No revision letter on the PCB.

Table 6. 892XA-521 Final Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	892XA-521 FINAL ASSEMBLY FIGURE 2 (892XA-521)	ORDER	BY	OPTION 892XA-521.			
-521	DMM DIGITAL INTERFACE PCB ASSEMBLY SEE FIGURE 3	471698	89536	471698	1		
H1	SCREW LOCKSET, CABLE	484196	00779	552568-1	1		
H2	SPACER, #6	104661	89536	104661	1		
H3	SCREW, PHP, 4-40 X 1-1/8	320069	89536	320069	1		
H4	SCREW, PHP, 4-40 X 1/4	256156	89536	256156	2		
H5	INSULATOR	515353	89536	515353	1		
W1	CABLE, DIGITAL DMM I/F (P2/J602)	503086	89536	503086	1		
W2	CABLE, DIGITAL DMM I/F (J1/P601)	486696	89536	486696	1		
Y7203	CABLE, INTERFACE	491001	89536	491001	1		
	INSTRUCTION MANUAL (NOT SHOWN)	510768	89536	510768	1		

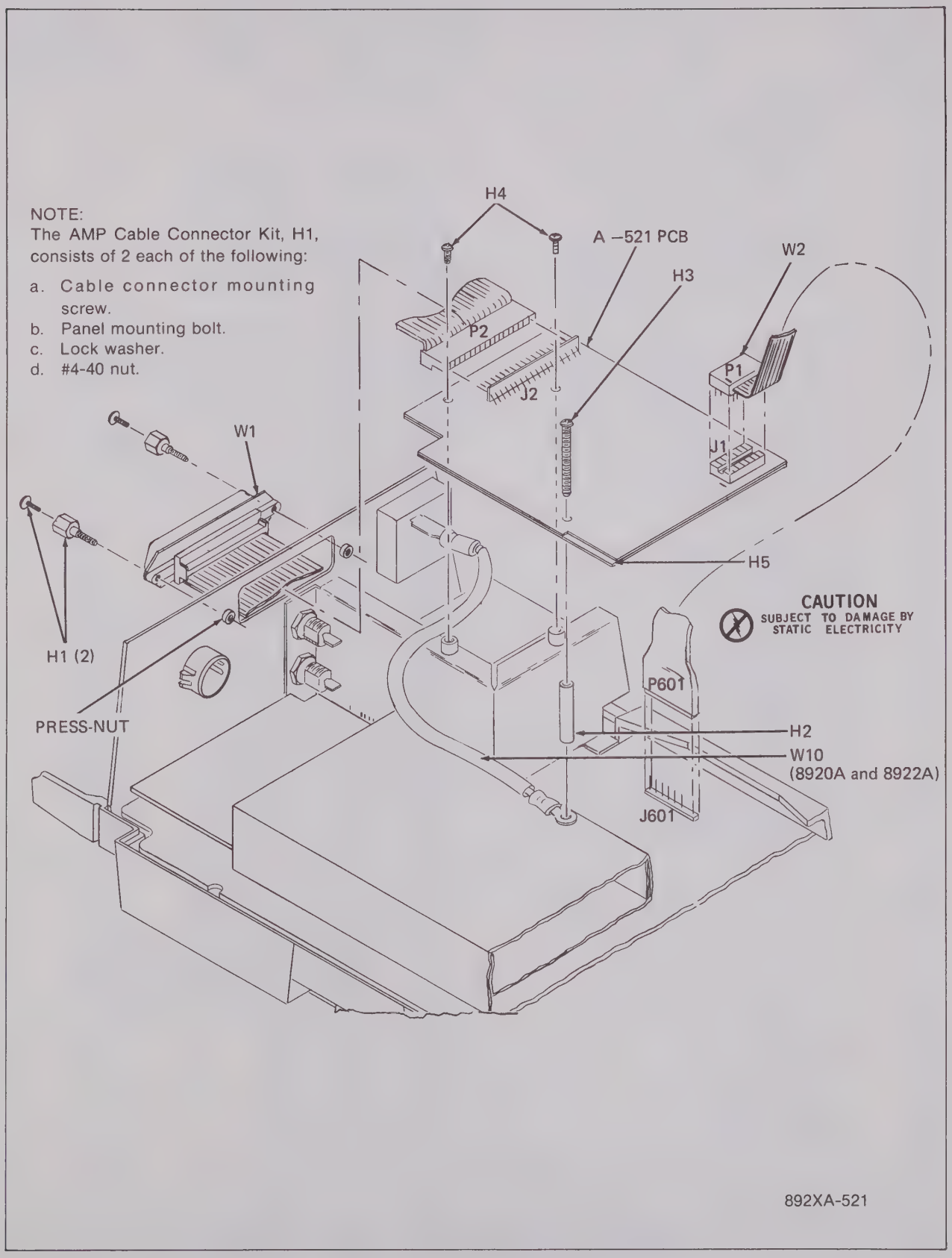
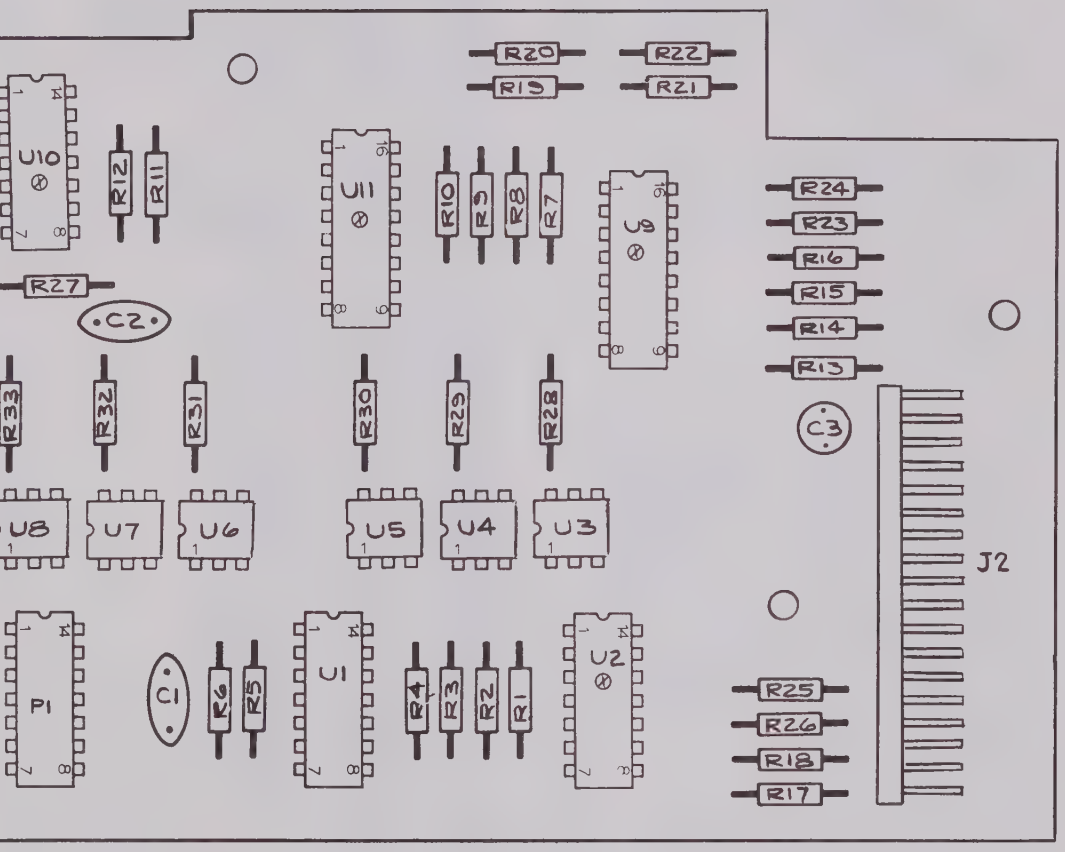


Figure 2. 892XA-521 Final Assembly

Table 7. DMM Digital Interface PCB Assembly, Option -521

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
-521Ⓧ	DMM DIGITAL INTERFACE PCB ASSEMBLY OPTION -521 FIGURE 3 (8X00A-4001T)	471698	89536	471698	AR		
C1	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F103M	2		
C2	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C3	CAP, TA, 10 UF +/-20%, 20V	330662	56289	196D106X0020KA1	1		
J2	CONNECTOR, 18 POS., RT ANGLE P/H ASSY.	501254	00779	1-640099-8	1		
P1	SOCKET, 14-PIN	276527	91506	314-AG39D	1		
R1	RES, DEP CAR, 390 +/-5%, 1/4W	441543	80031	CR251-4-5P390E	6		
R2	RES, DEP CAR, 390 +/-5%, 1/4W	441543	80031	CR251-4-5P390E	REF		
R3	RES, DEP CAR, 390 +/-5%, 1/4W	441543	80031	CR251-4-5P390E	REF		
R4	RES, DEP CAR, 390 +/-5%, 1/4W	441543	80031	CR251-4-5P390E	REF		
R5	RES, DEP CAR, 390 +/-5%, 1/4W	441543	80031	CR251-4-5P390E	REF		
R6	RES, DEP CAR, 390 +/-5%, 1/4W	441543	80031	CR251-4-5P390E	REF		
R7	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	11		
R8	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R9	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R10	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R11	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R12	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R13	RES, DEP CAR, 470 +/-5%, 1/4W	343434	80031	CR251-4-5P470E	6		
R14	RES, DEP CAR, 470 +/-5%, 1/4W	343434	80031	CR251-4-5P470E	REF		
R15	RES, DEP CAR, 470 +/-5%, 1/4W	343434	80031	CR251-4-5P470E	REF		
R16	RES, DEP CAR, 470 +/-5%, 1/4W	343434	80031	CR251-4-5P470E	REF		
R17	RES, DEP CAR, 470 +/-5%, 1/4W	343434	80031	CR251-4-5P470E	REF		
R18	RES, DEP CAR, 470 +/-5%, 1/4W	343434	80031	CR251-4-5P470E	REF		
R19	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R20	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R21	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R22	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R23	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	10		
R24	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
R25	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
R26	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
R27	RES, DEP CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R28	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
R29	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
R30	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
R31	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
R32	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
R33	RES, DEP CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	REF		
U1	IC, TTL, HEX INVERTER	393058	01295	SN74LS04N	1	1	
U2Ⓧ	IC, C-MOS, DUAL D-TYPE F/F	340117	12040	MM5613AN	1	1	
U3	OPTO-ISOLATOR	504977	29083	MCT2E	6	2	
U4	OPTO-ISOLATOR	504977	29083	MCT2E	REF		
U5	OPTO-ISOLATOR	504977	29083	MCT2E	REF		
U6	OPTO-ISOLATOR	504977	29083	MCT2E	REF		
U7	OPTO-ISOLATOR	504977	29083	MCT2E	REF		
U8	OPTO-ISOLATOR	504977	29083	MCT2E	REF		
U9Ⓧ	IC, C-MOS, 3-STATE INVERTING BUFFER	454819	12040	MM80C98N	1	1	
U10Ⓧ	IC, C-MOS, QUAD 2-IN, NOR GATE	429944	12040	CD4001BN	1	1	
U11Ⓧ	IC, C-MOS, BCD TO DECIMAL DECODER	407981	12040	MM74C42N	1	1	



CAUTION
SUBJECT TO DAMAGE BY
STATIC ELECTRICITY

8X00A-1601

Figure 3. DMM Digital Interface PCB Assembly, Option -521

Table 8. DMM-1120A Interface PCB Assembly, Option -522

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
-522	Ⓐ DMM-1120A INTERFACE PCB ASSEMBLY DIGITAL MULTIMETER OPTION -522 FIGURE 4 (8X00A-4011T)	503078	89536	503078	1		
C1	CAP, TA, 2.2 UF +/-20%, 20V	161927	56289	196D225X0020HA1	1		
C2	CAP, MYLAR, 0.047 UF +/-10%, 250V	162008	73445	C280MAEA47K	1		
C3	CAP, CER, 20 PF +/-10%, 500V	106369	72982	831-000-T2H0-200K	2		
C4	CAP, CER, 20 PF +/-10%, 500V	106369	72982	831-000-T2H0-200K	REF		
C5	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F103M	1		
H1	HARDWARE KIT	484196	00779	552568-1	1		
J11	CONN, PCB, MTG	484170	00779	552238-1	1		
MP1	STRAP, (ON Y1)	172080	06383	SST-1M	1		
R1	RES, DEP CAR, 470 +/-5%, 1/4W	343434	80031	CR251-45P470E	4		
R2	RES, DEP CAR, 470 +/-5%, 1/4W	343434	80031	CR251-45P470E	REF		
R3	RES, DEP CAR, 470 +/-5%, 1/4W	343434	80031	CR251-45P470E	REF		
R4	RES, DEP CAR, 470 +/-5%, 1/4W	343434	80031	CR251-45P470E	REF		
RN1	RES, NETWORK, 100K	461038	89536	461038	1	1	
RN2	RES, NETWORK, 10K	414003	89536	414003	2	1	
RN3	RES, NETWORK, 10K	364000	89536	364000	1	1	
RN4	RES, NETWORK, 10K	414003	89536	414003	REF		
U1	IC, CHIP MICRO-PROCESSOR	495077	89536	495077	1		
U2	Ⓐ IC, C-MOS, 3-STATE, INVERT/BUFFER	454819	12040	MM80C98N	6	2	
U3	Ⓐ IC, C-MOS, 3-STATE, INVERT/BUFFER	454819	12040	MM80C98N	REF		
U4	Ⓐ IC, C-MOS, 3-STATE, INVERT/BUFFER	454819	12040	MM80C98N	REF		
U5	Ⓐ IC, C-MOS, 3-STATE, INVERT/BUFFER	454819	12040	MM80C98N	REF		
U6	Ⓐ IC, C-MOS, 3-STATE, INVERT/BUFFER	454819	12040	MM80C98N	REF		
U7	IC, QUAD 2-INPUT POS NAND GATES	394205	01295	SN74LS03	1	1	
U8	Ⓐ IC, C-MOS, QUAD 2-INPUT NAND S-TRIGGERS	404632	02735	CD4093BE	1	1	
U9	Ⓐ IC, C-MOS, HEX INVERTER	404681	02735	CD4069UBE	1	1	
U10	Ⓐ IC, C-MOS, TRI-STATE HEX NON-CNUT BFFRS	407759	12040	MM80C97N	1	1	
U11	Ⓐ IC, C-MOS, 3-STATE, INVERT/BUFFER	454819	12040	MM80C98N	REF		
XU1	SOCKET IC, 40-PIN	429282	09922	DILB40P-108	1		
Y1	CRYSTAL, 3.2 MHZ	460550	89536	460550	1		

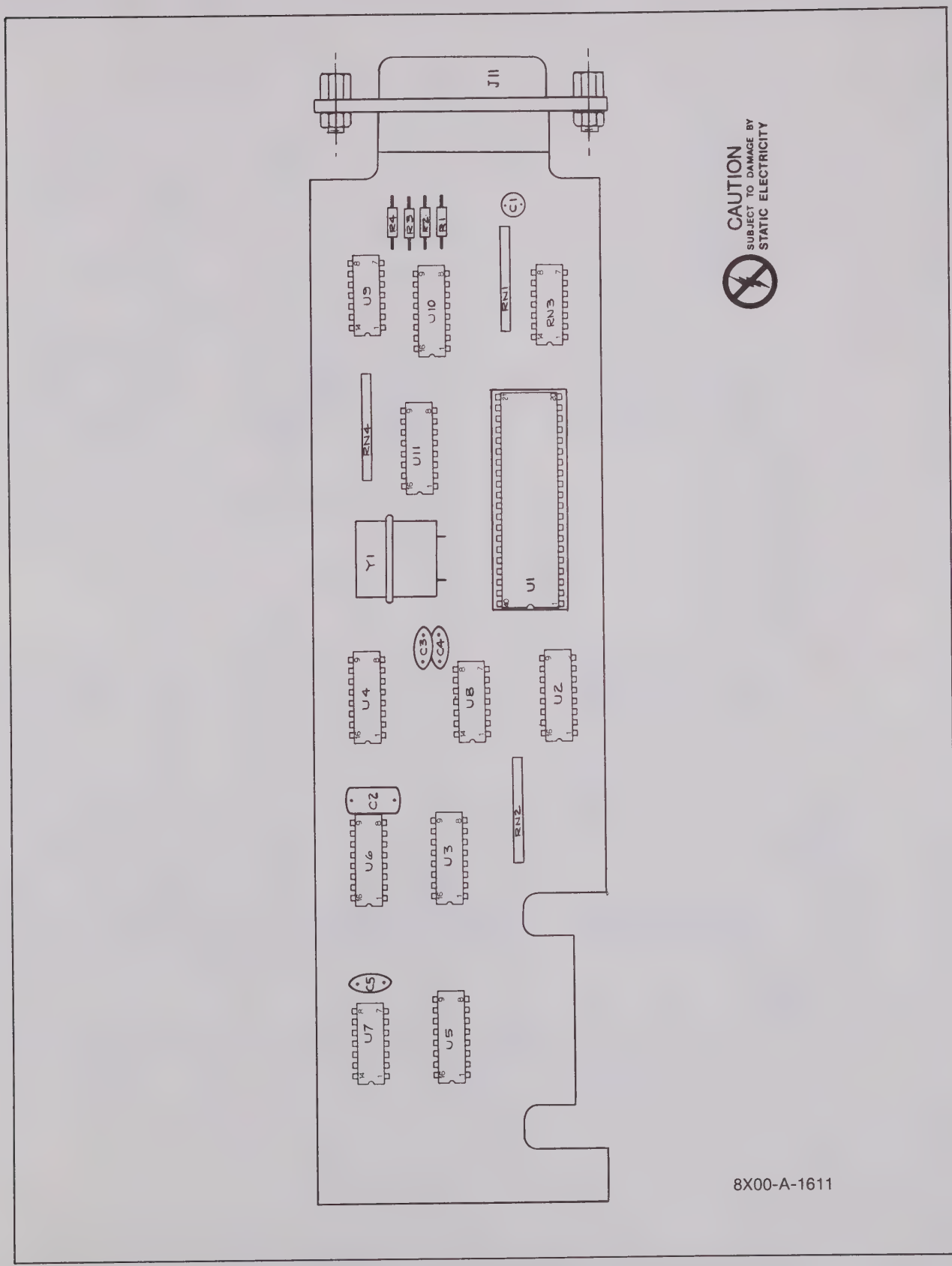
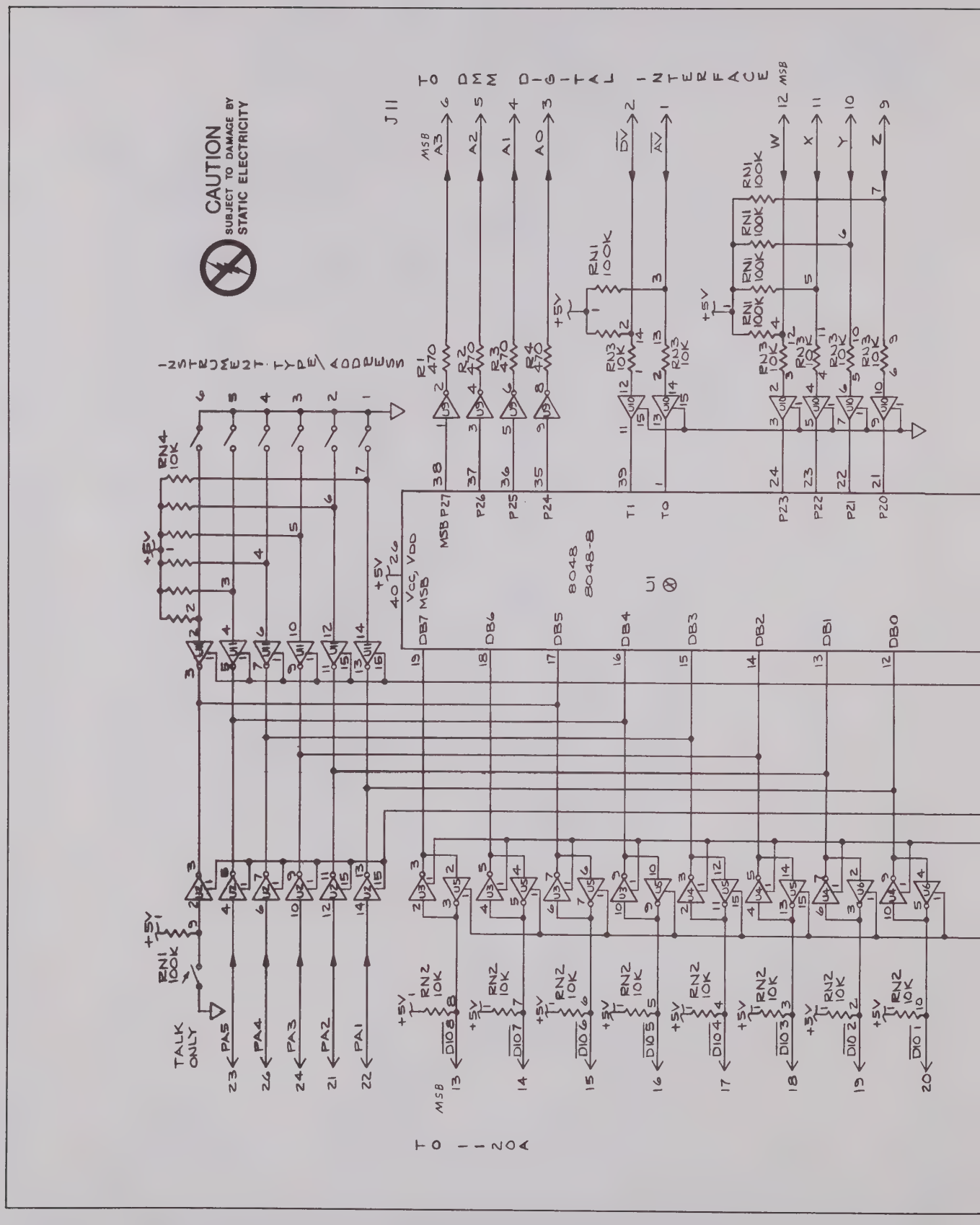


Figure 4. DMM-1120A Interface PCB Assembly, Option -522


CAUTION
SUBJECT TO DAMAGE BY STATIC ELECTRICITY
J11
TO DMM D-G-TAL INTERFACE
MSB A3
A2
A1
A0
DV
AV
MSB
W
X
Y
Z
RN1 100K
RN3 10K
R1 470
R2 470
R3 470
R4 470
+5V
-2SELECT TYPE ADDRESS-
RN4 10K
TALK ONLY
PA5
PA4
PA3
PA2
PA1
RN2 10K
DIO8
DIO7
DIO6
DIO5
DIO4
DIO3
DIO2
DIO1
MSB
P27
P26
P25
P24
T1
T0
P23
P22
P21
P20
Vcc, Vdd
DB7 MSB
DB6
DB5
DB4
DB3
DB2
DB1
DB0
8048
8048-8
U1
TO --204

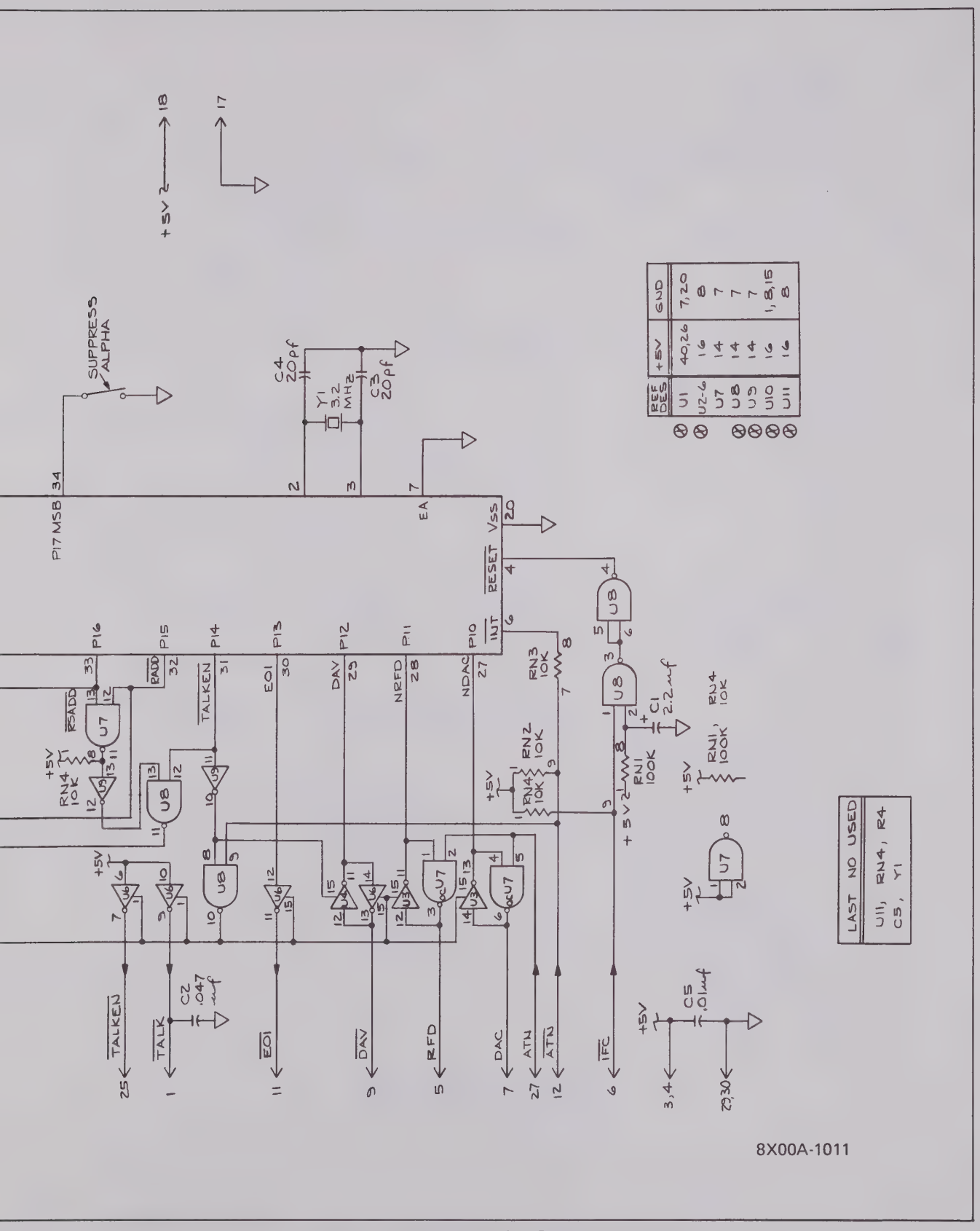
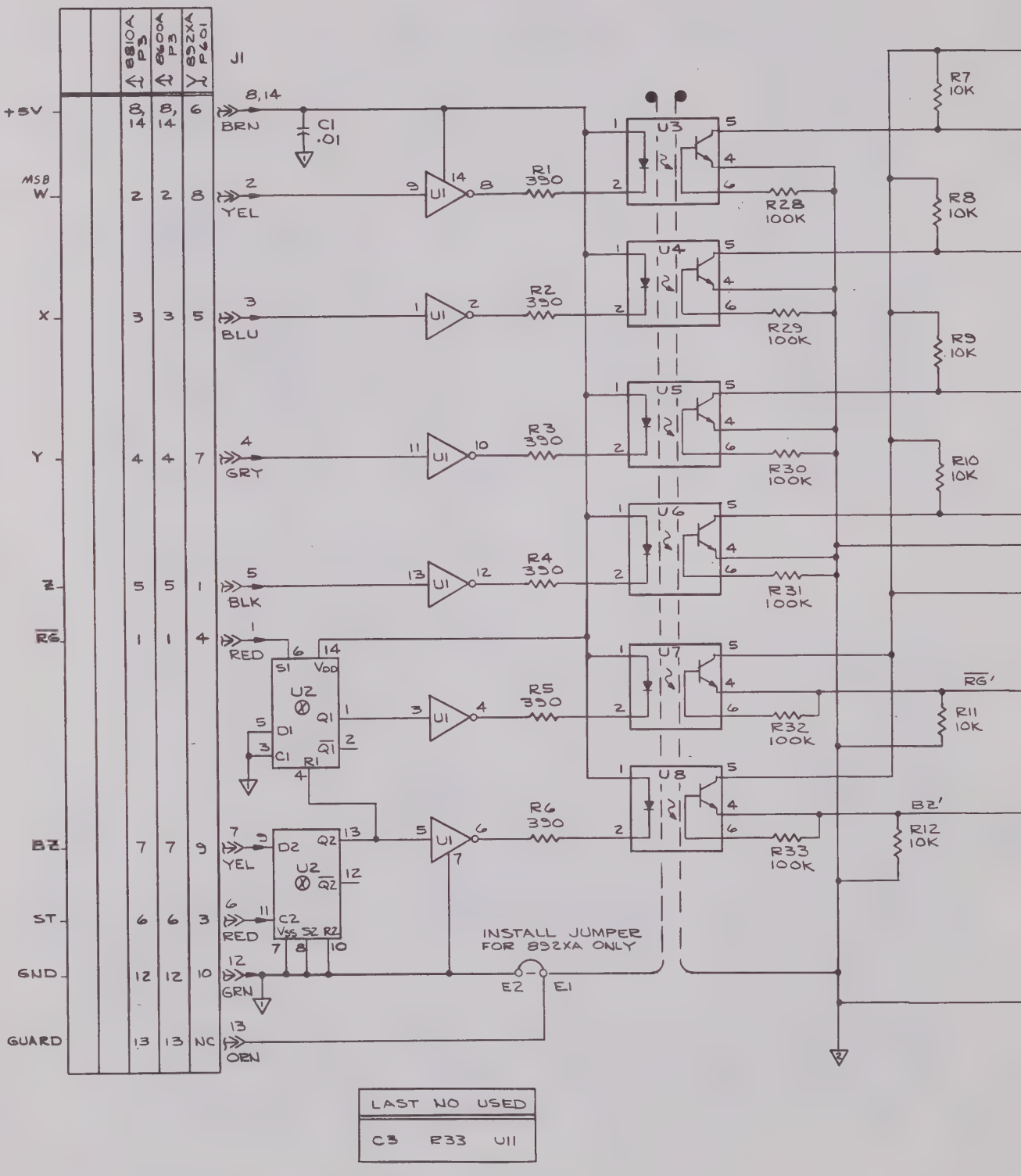


Figure 5. DMM-1120A Interface PCB Assembly, Option -522



LAST NO USED		
C3	E33	U11

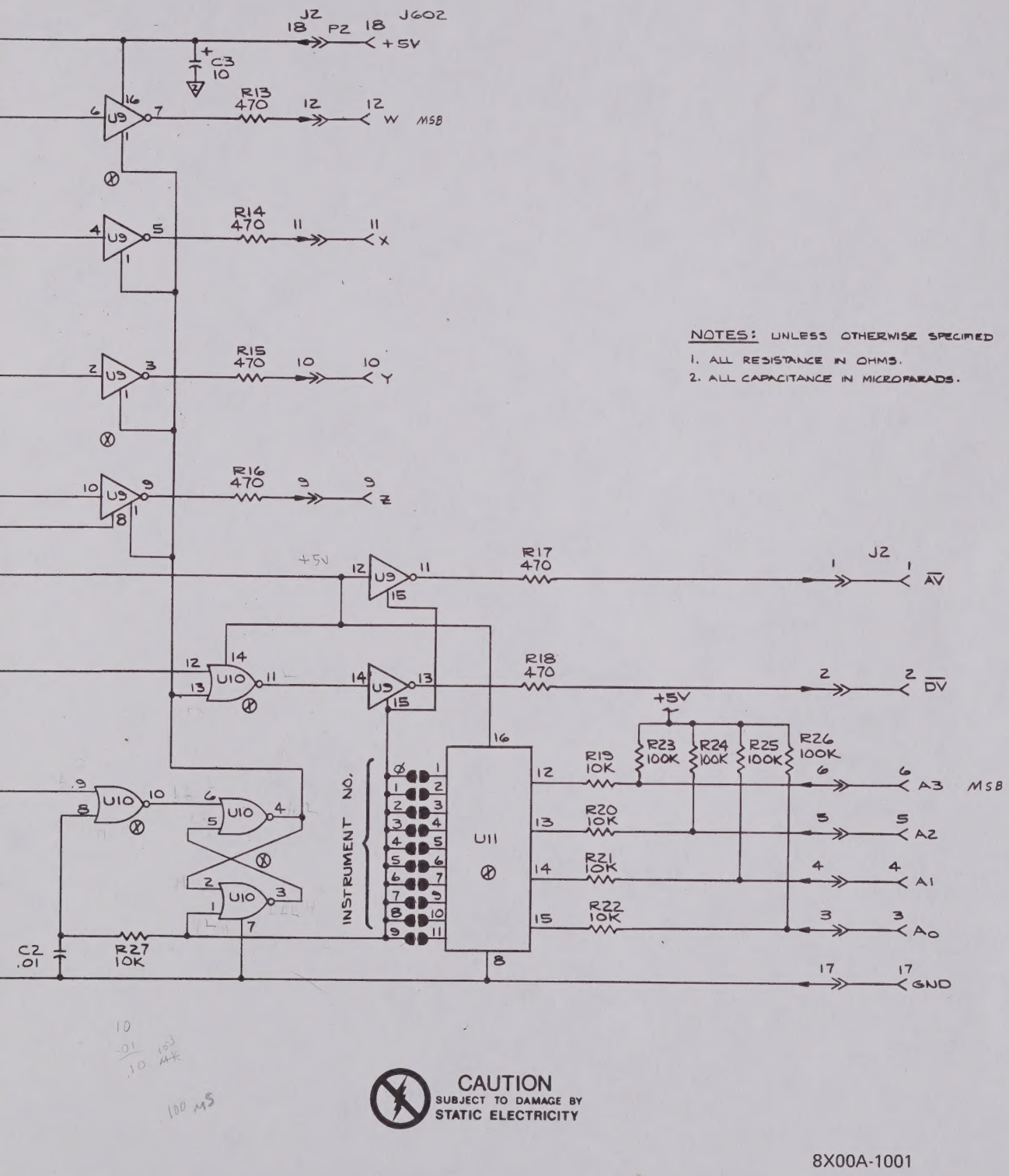


Figure 6. DMM Digital Interface PCB Assembly, Option -521

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